US006349449B1

(12) **United States Patent**
Kuehl

(10) **Patent No.: US 6,349,449 B1**
(45) **Date of Patent: Feb. 26, 2002**

(54) **HINGE FOR ACCOMMODATING A PIVOTING COMPONENT**

(75) Inventor: **Hans Kuehl**, Plochingen (DE)

(73) Assignee: **DaimlerChyrsler AG**, Stuttgart (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/446,798**

(22) PCT Filed: **Jun. 16, 1998**

(86) PCT No.: **PCT/EP98/03611**

§ 371 Date: **May 3, 2000**

§ 102(e) Date: **May 3, 2000**

(87) PCT Pub. No.: **WO98/59139**

PCT Pub. Date: **Dec. 30, 1998**

(30) **Foreign Application Priority Data**

Jun. 23, 1997 (DE) 197 26 536

(51) **Int. Cl.**[7] **E05C 17/64**
(52) **U.S. Cl.** **16/342**; 16/332
(58) **Field of Search** 16/342, 337, 341, 16/343, 344, 345

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,458,707 A * 1/1949 Jacobs 16/342
4,734,955 A * 4/1988 Conor 16/332
5,500,982 A * 3/1996 Hosoi 16/297
5,761,769 A * 6/1998 Bruckner et al. 16/342

FOREIGN PATENT DOCUMENTS

DE	44 06 824	A1	9/1995
DE	196 00 063	A1	5/1997
DE	196 25 556	A1	1/1998
DE	196 25 557	A1	1/1998

* cited by examiner

Primary Examiner—Anthony Knight
Assistant Examiner—Mark Williams
(74) *Attorney, Agent, or Firm*—Crowell & Moring LLP

(57) **ABSTRACT**

In order to achieve the situation where a pivotably mounted structural part, under the action of an adjusting force, is made to move indeed automatically but merely with braking and damping action, and thus at a reduced speed and with reduced kinetic energy, provision is made for the hinge which mounts the structural part to be equipped with a pivot brake, of which the braking force applied over the pivoting distance is smaller than the adjusting force and is adapted to the progression of the adjusting force over the pivoting distance. In selected regions, the braking force of the pivot brake may be greater than the adjusting force, in order to retain the structural part in these regions. The braking work performed by the pivot brake is advantageously calculated so as to absorb 20% to 25% of the adjusting work performed by the adjusting force.

23 Claims, 3 Drawing Sheets

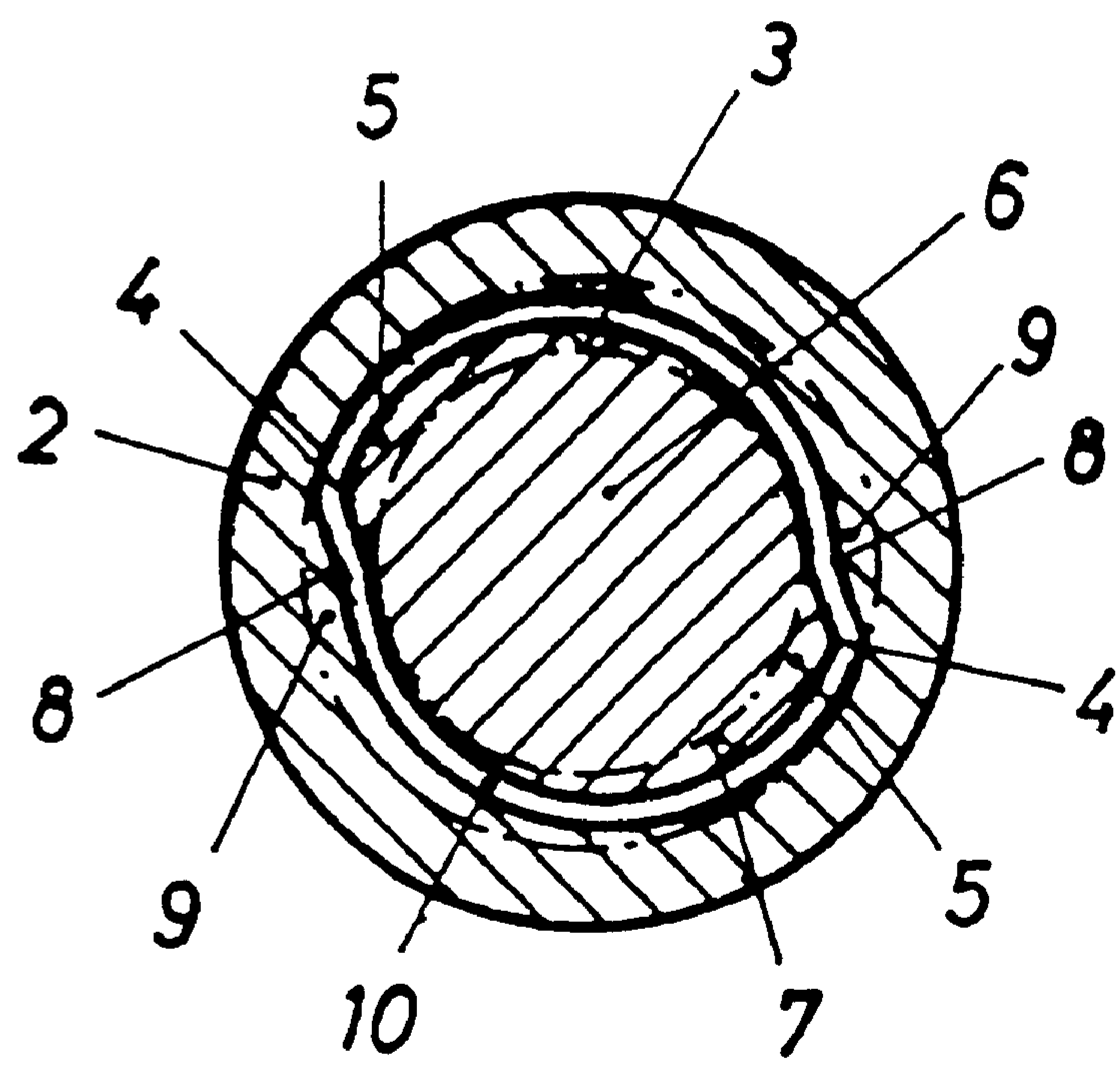


Fig. 1

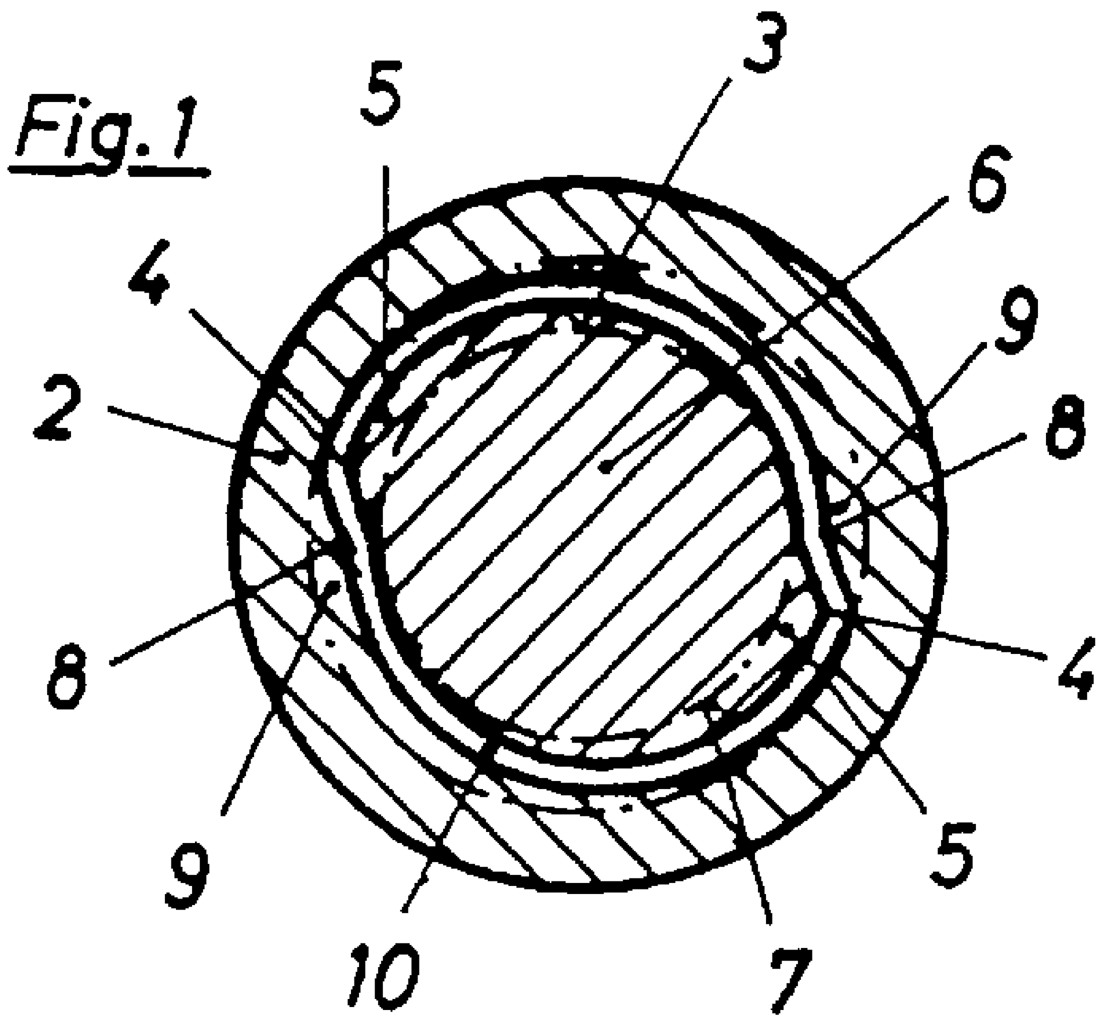


Fig. 2

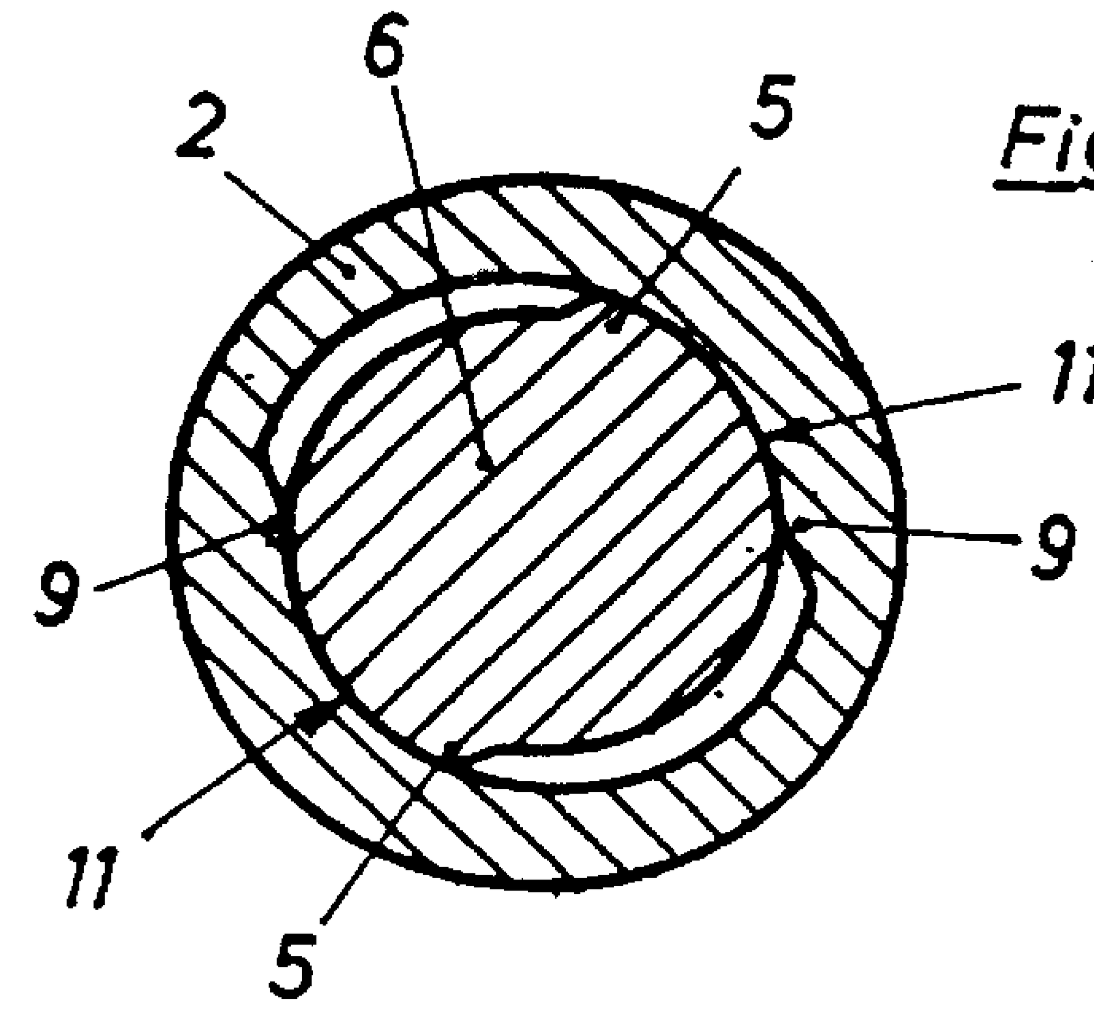


Fig. 3

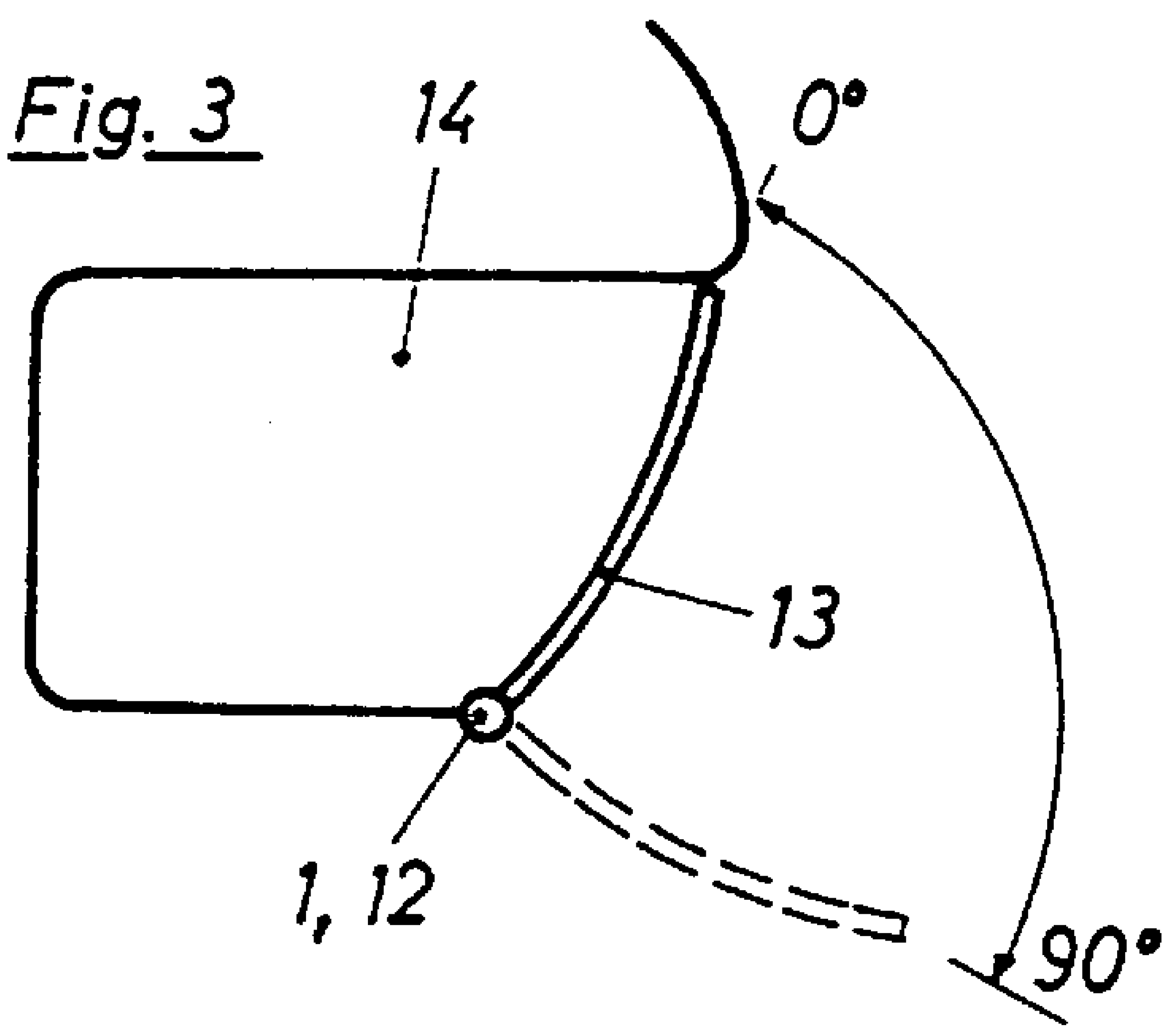


Fig. 4

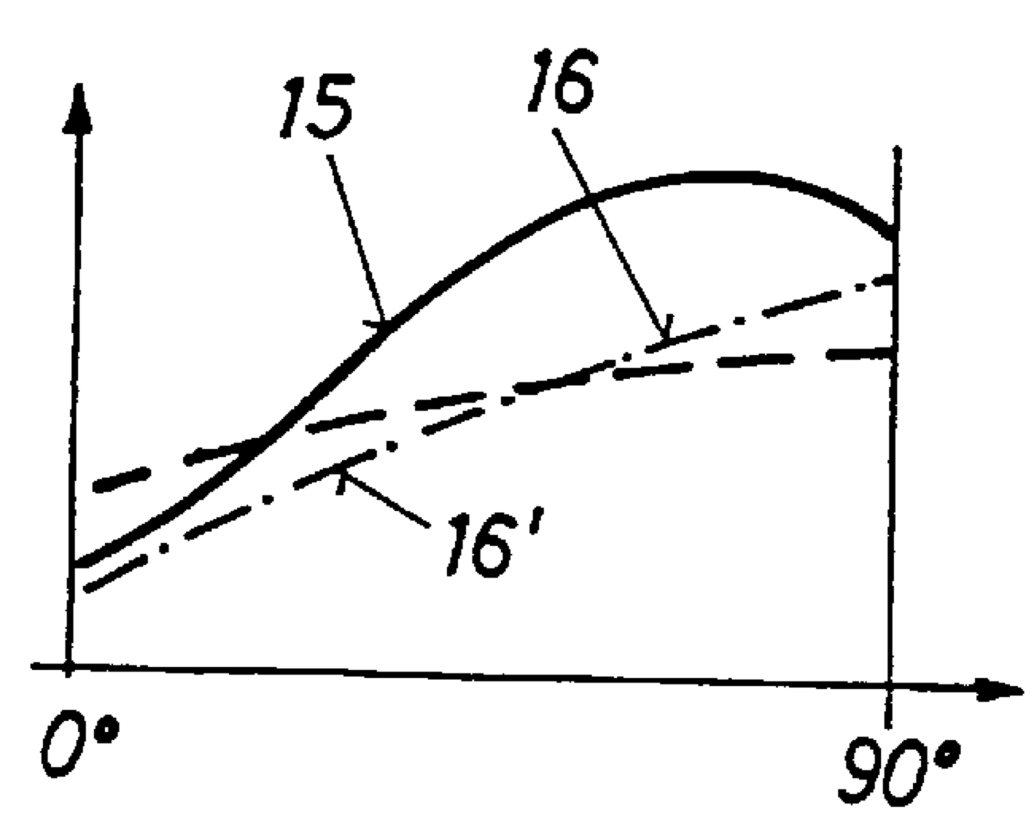


Fig. 5

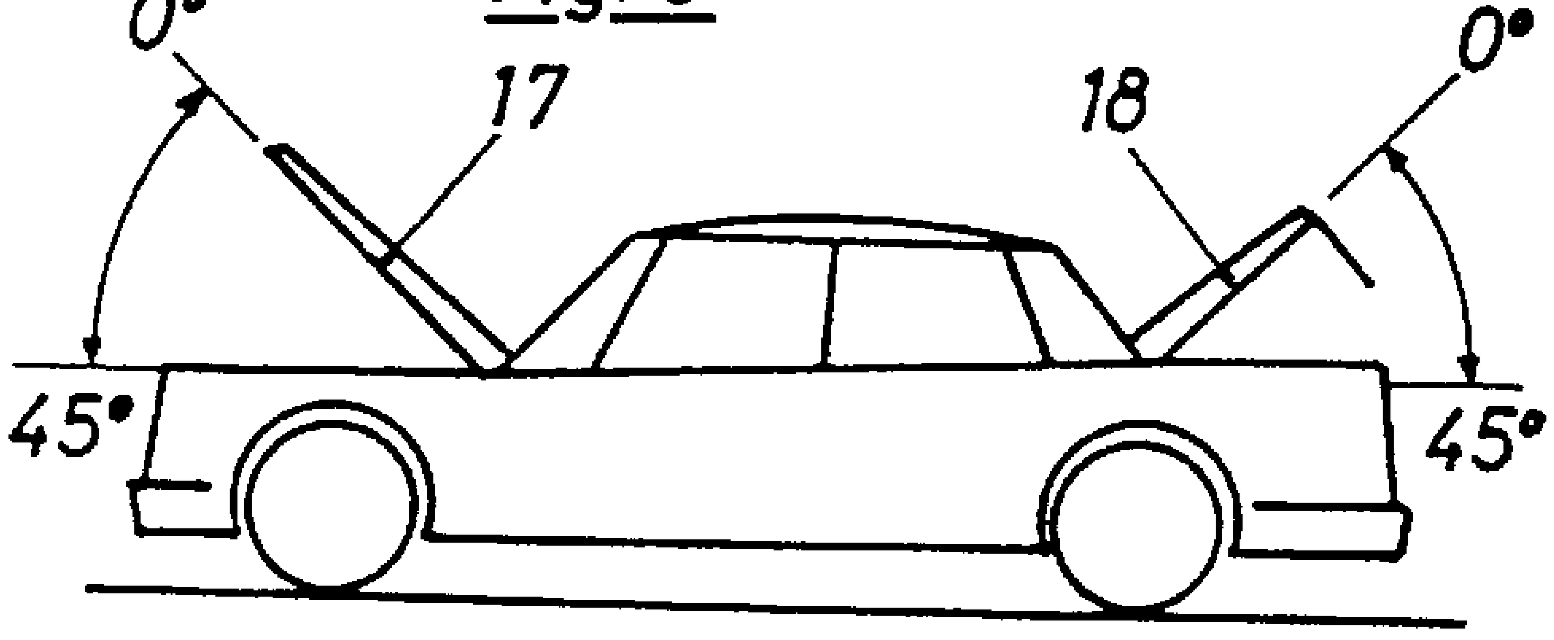


Fig. 6

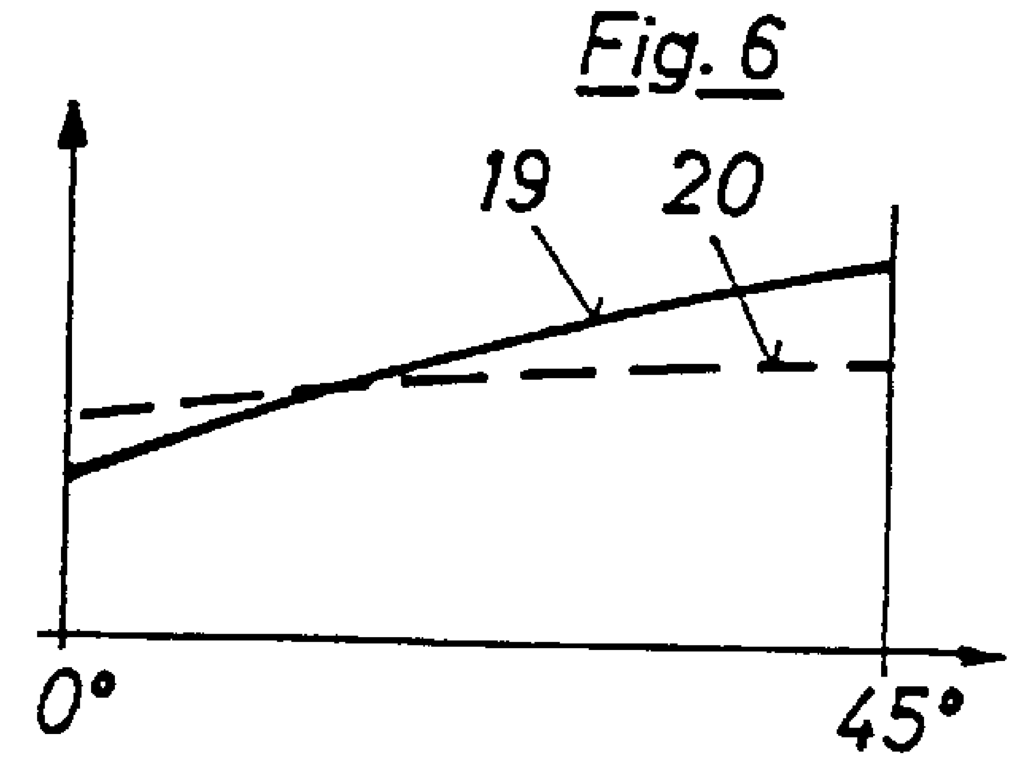


Fig. 7

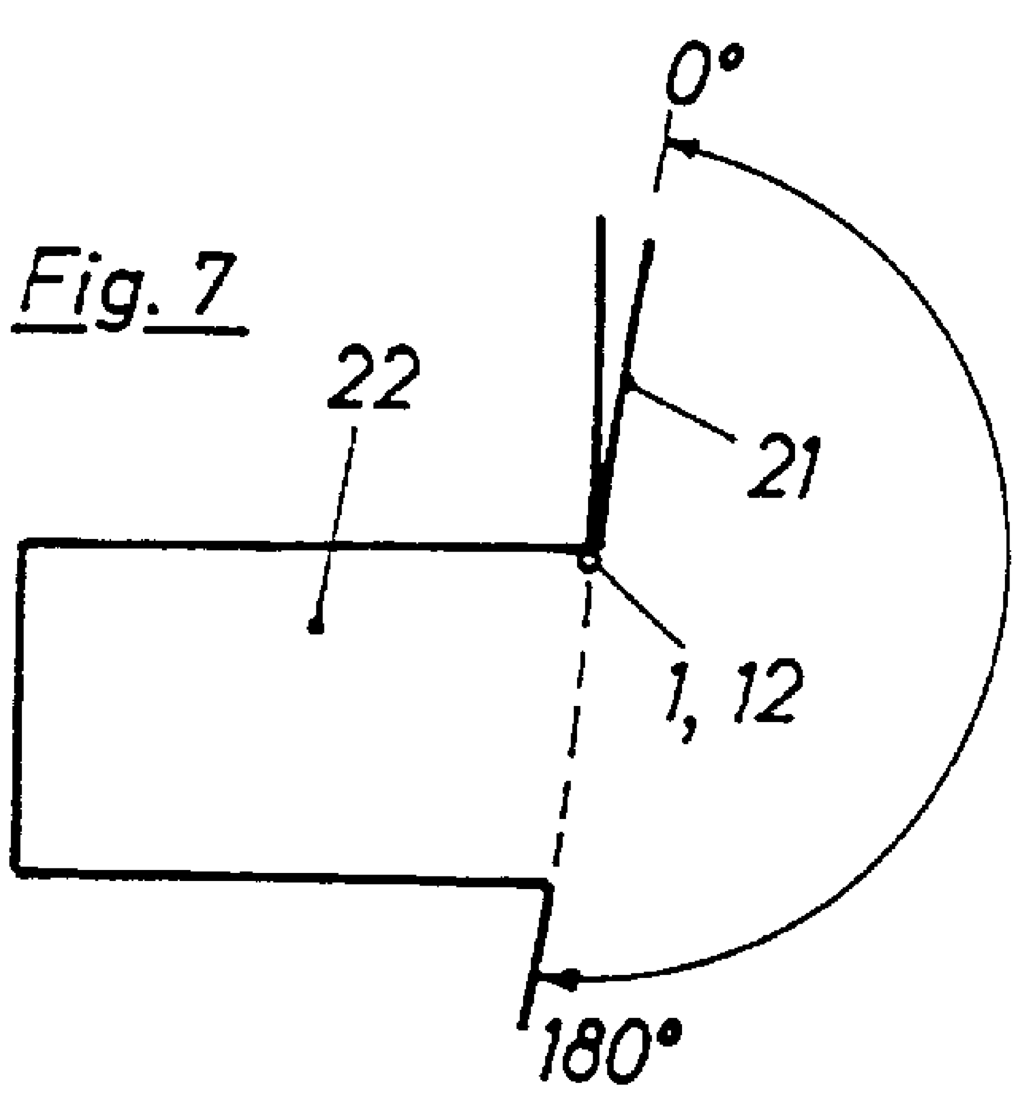
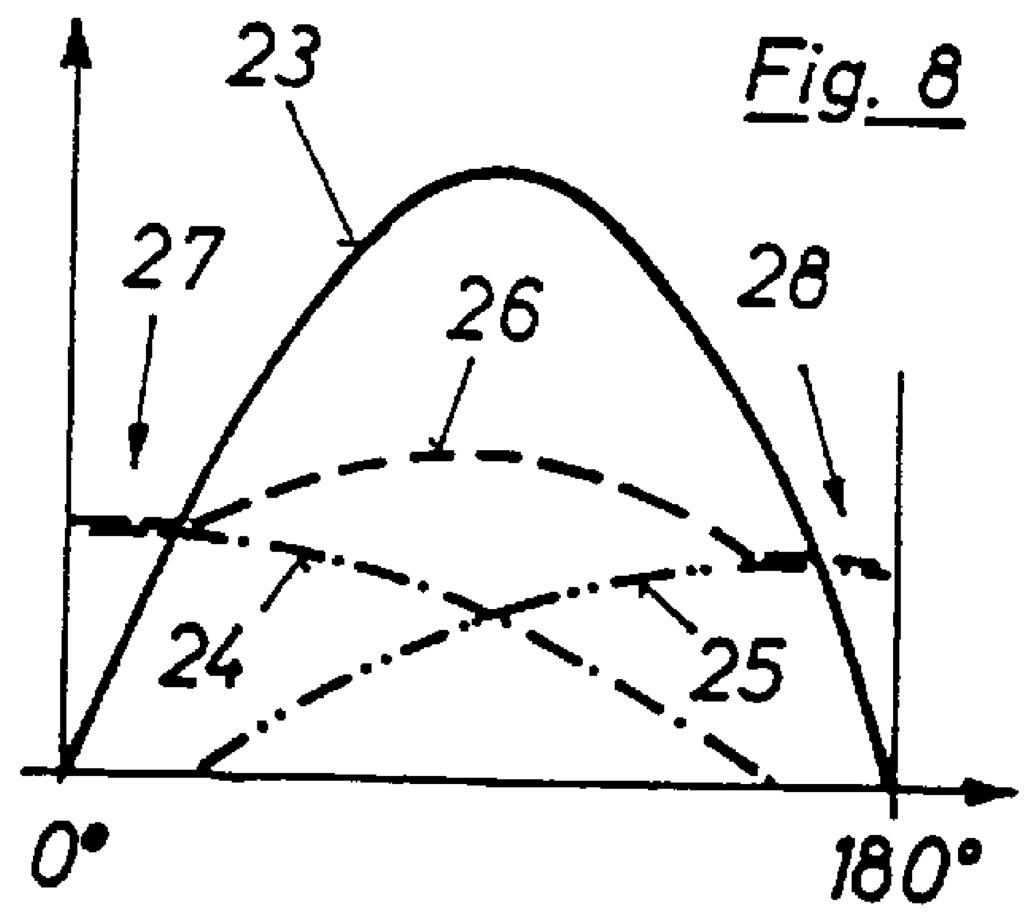


Fig. 8



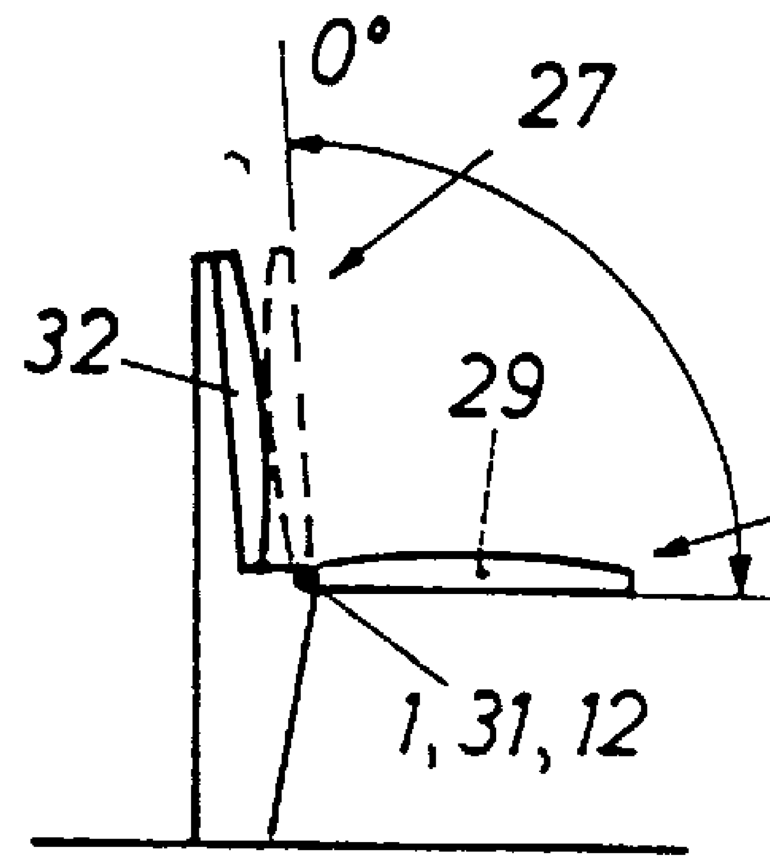


Fig. 9

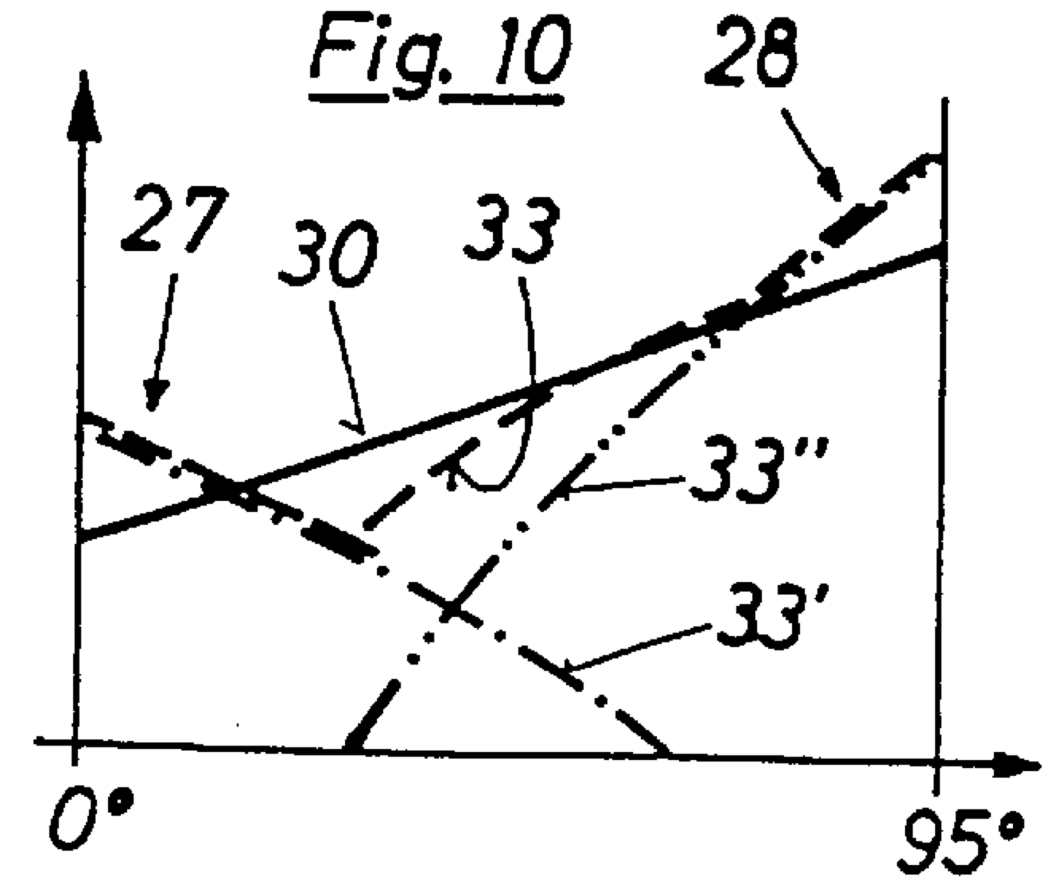


Fig. 10

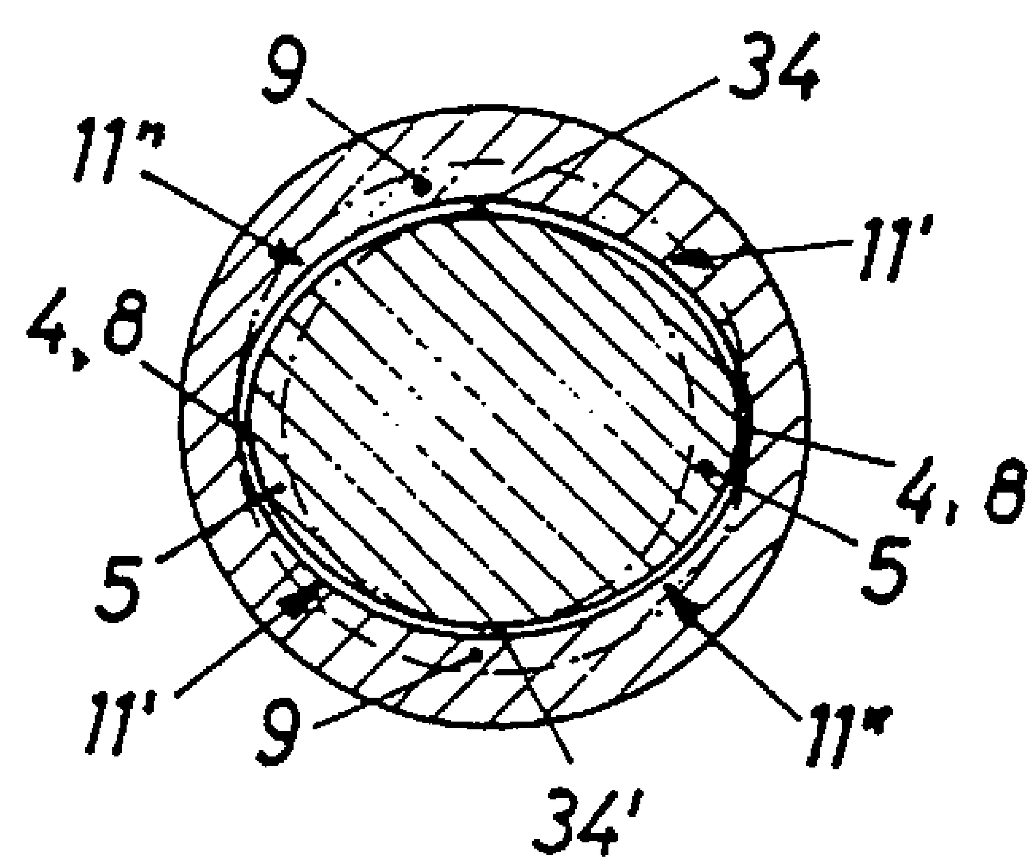


Fig. 11

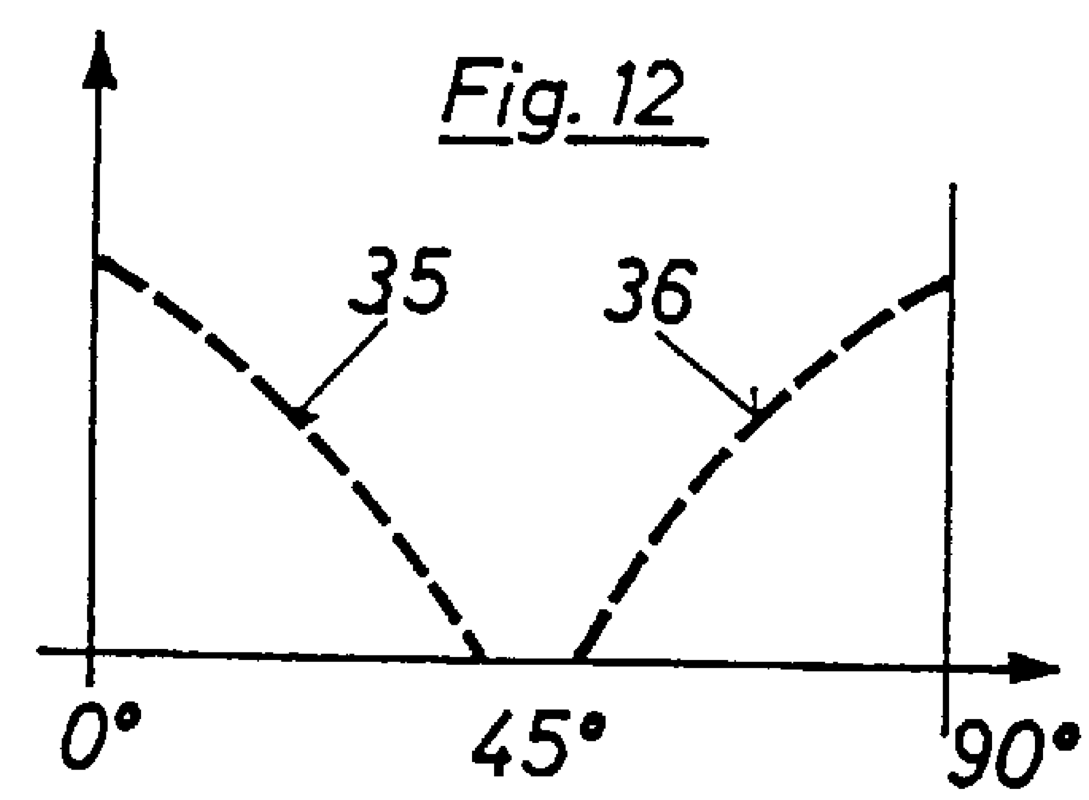


Fig. 12

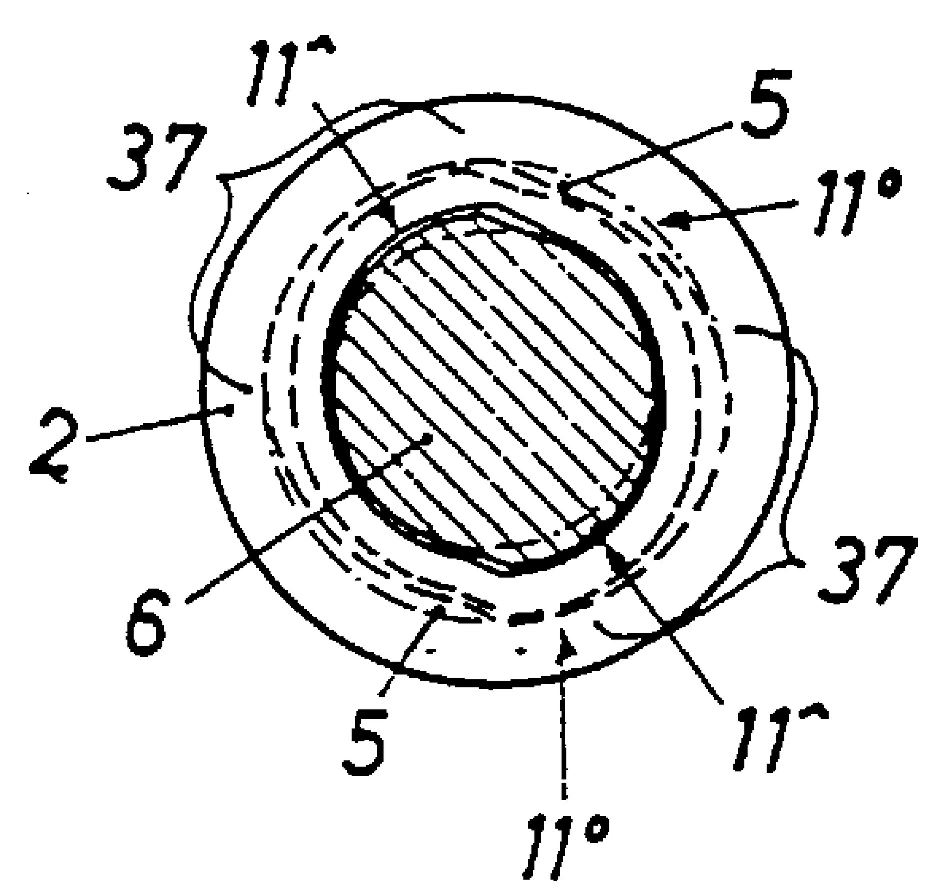


Fig. 13

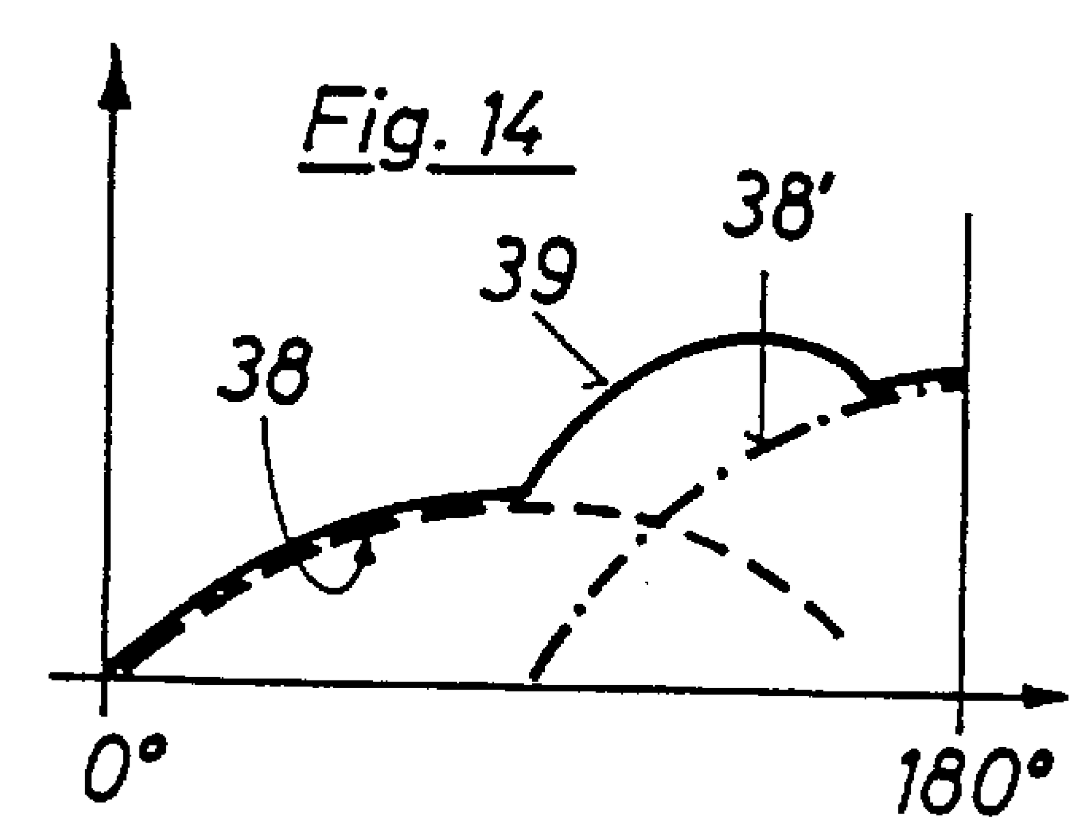


Fig. 14

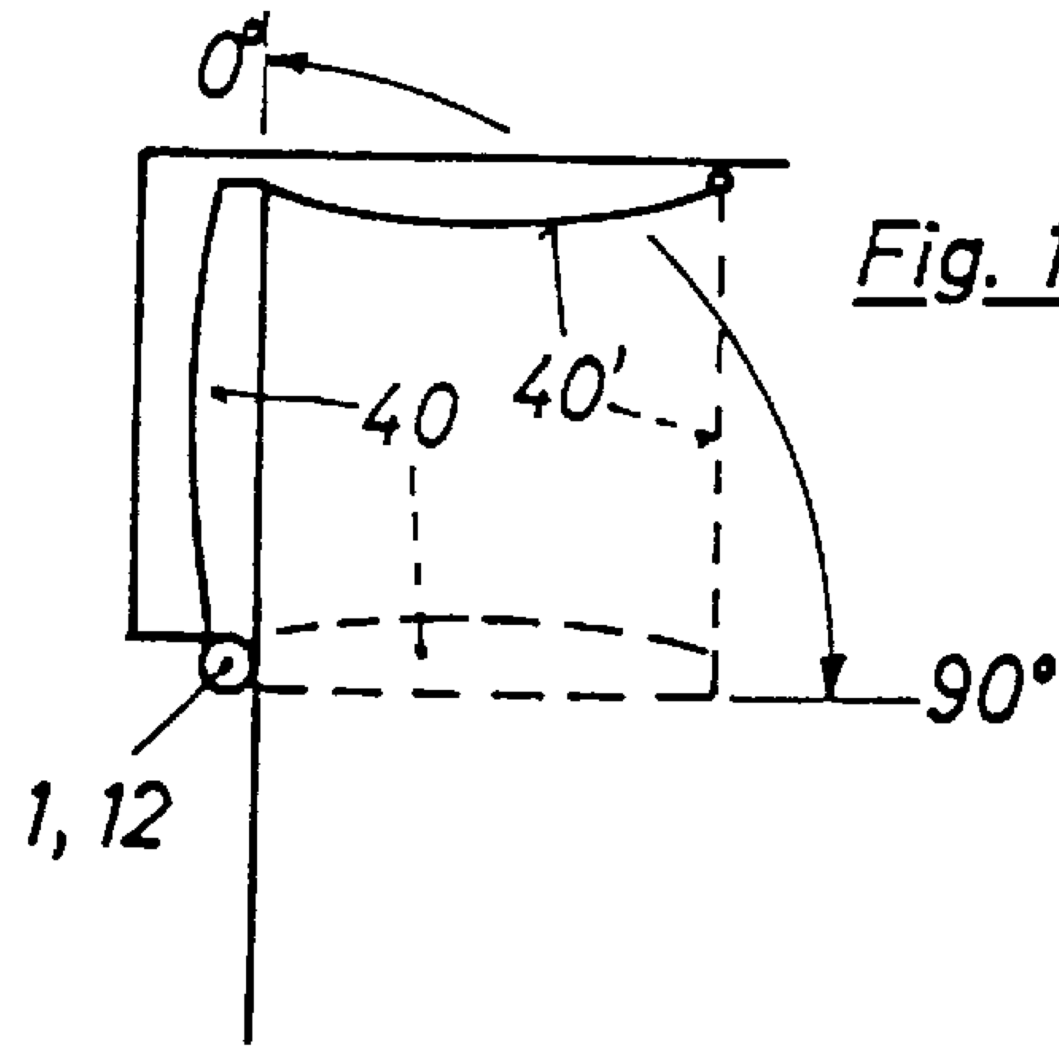


Fig. 15

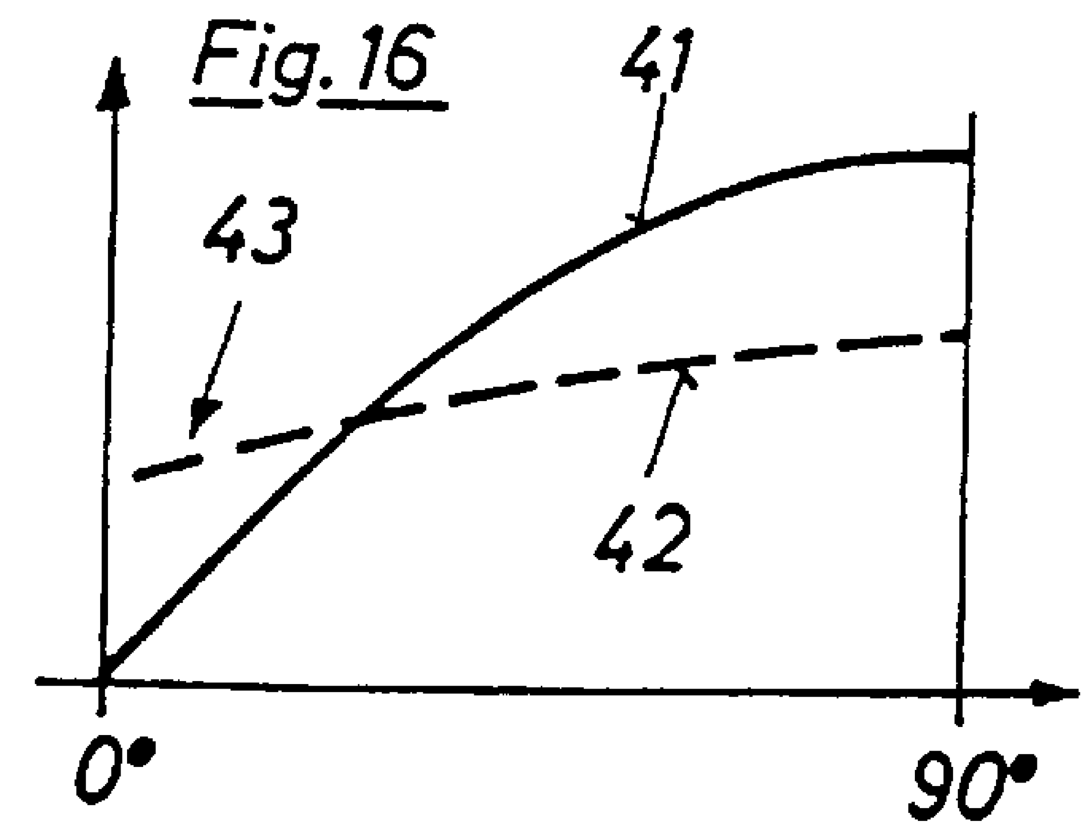


Fig. 16

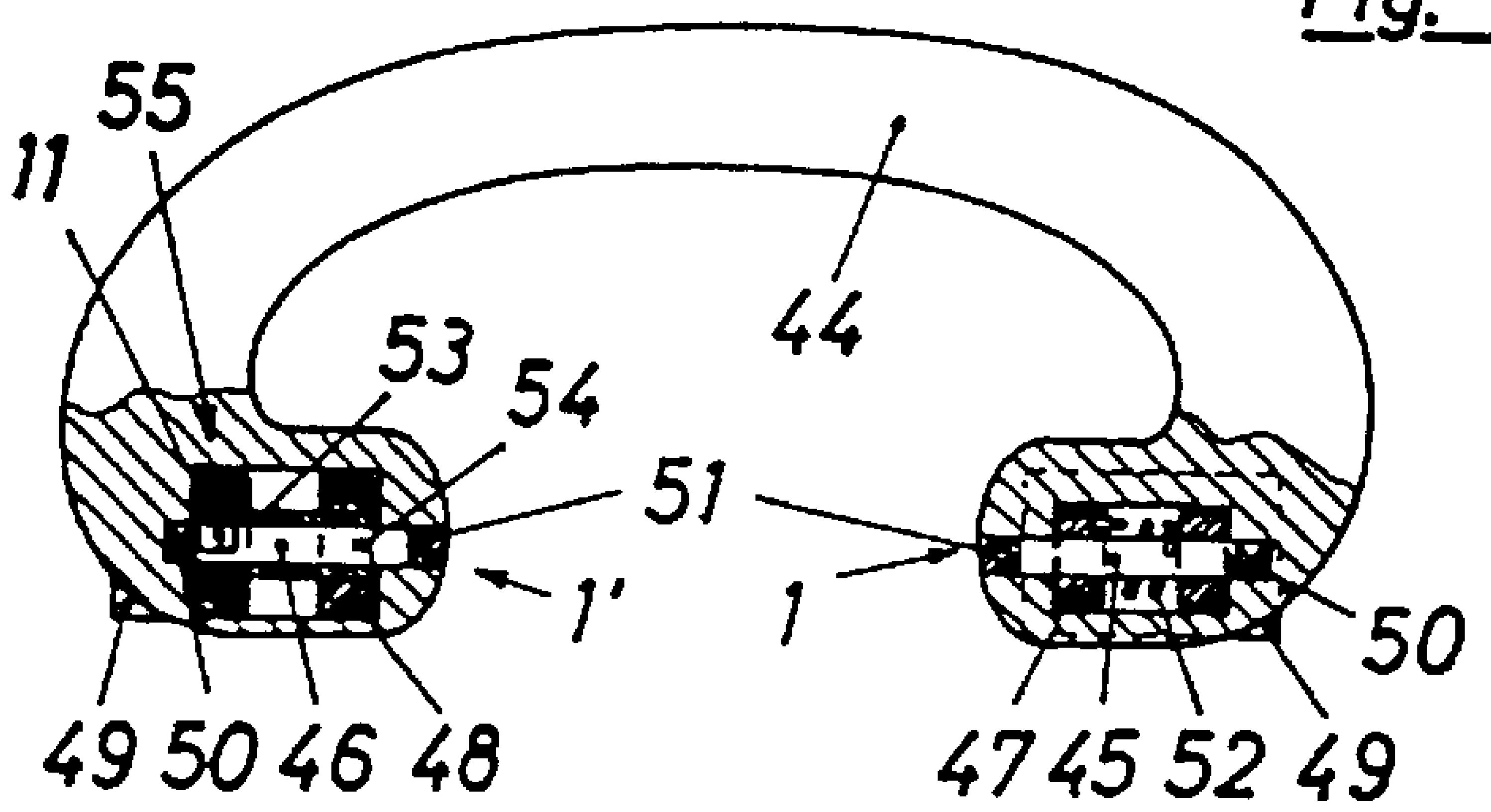


Fig. 17

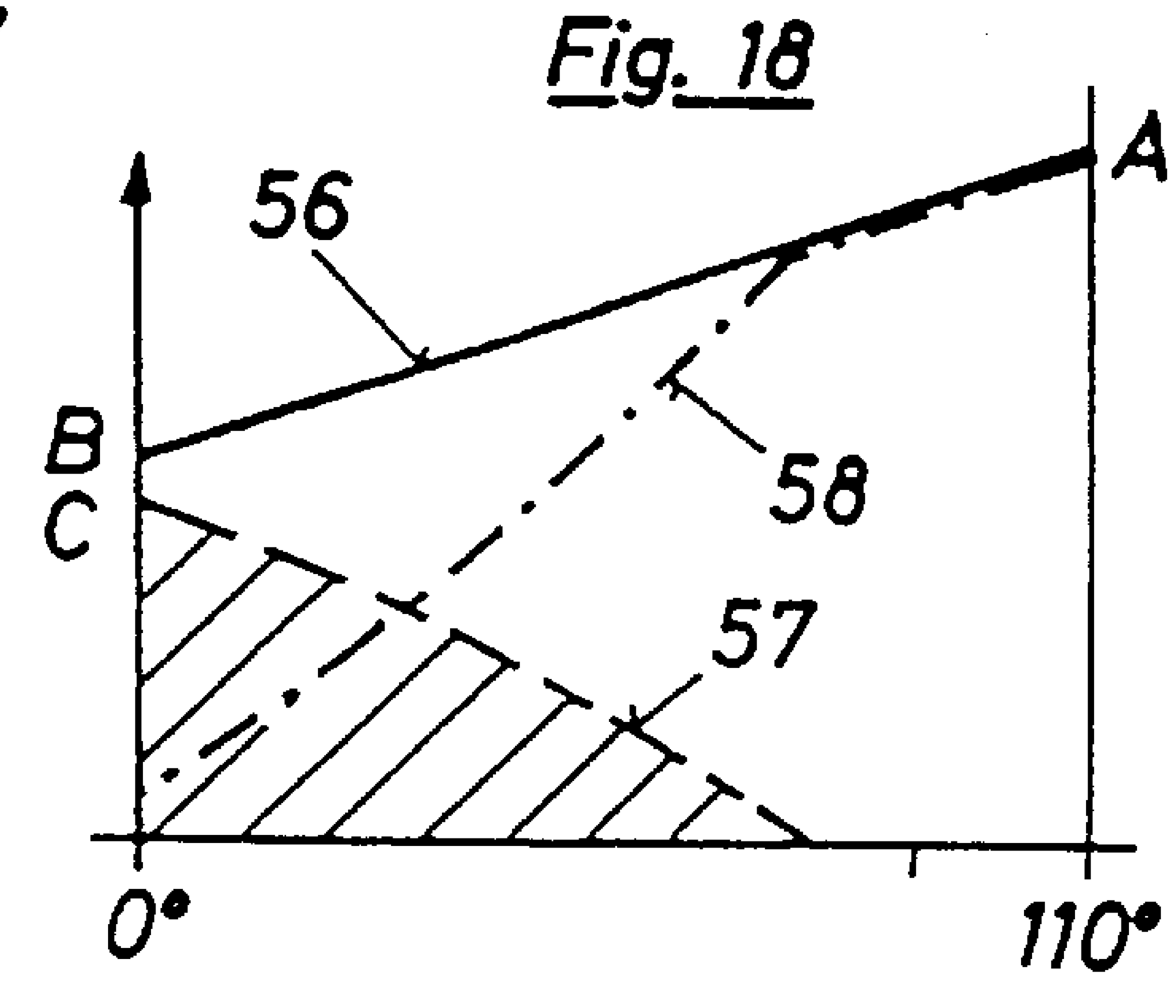


Fig. 18

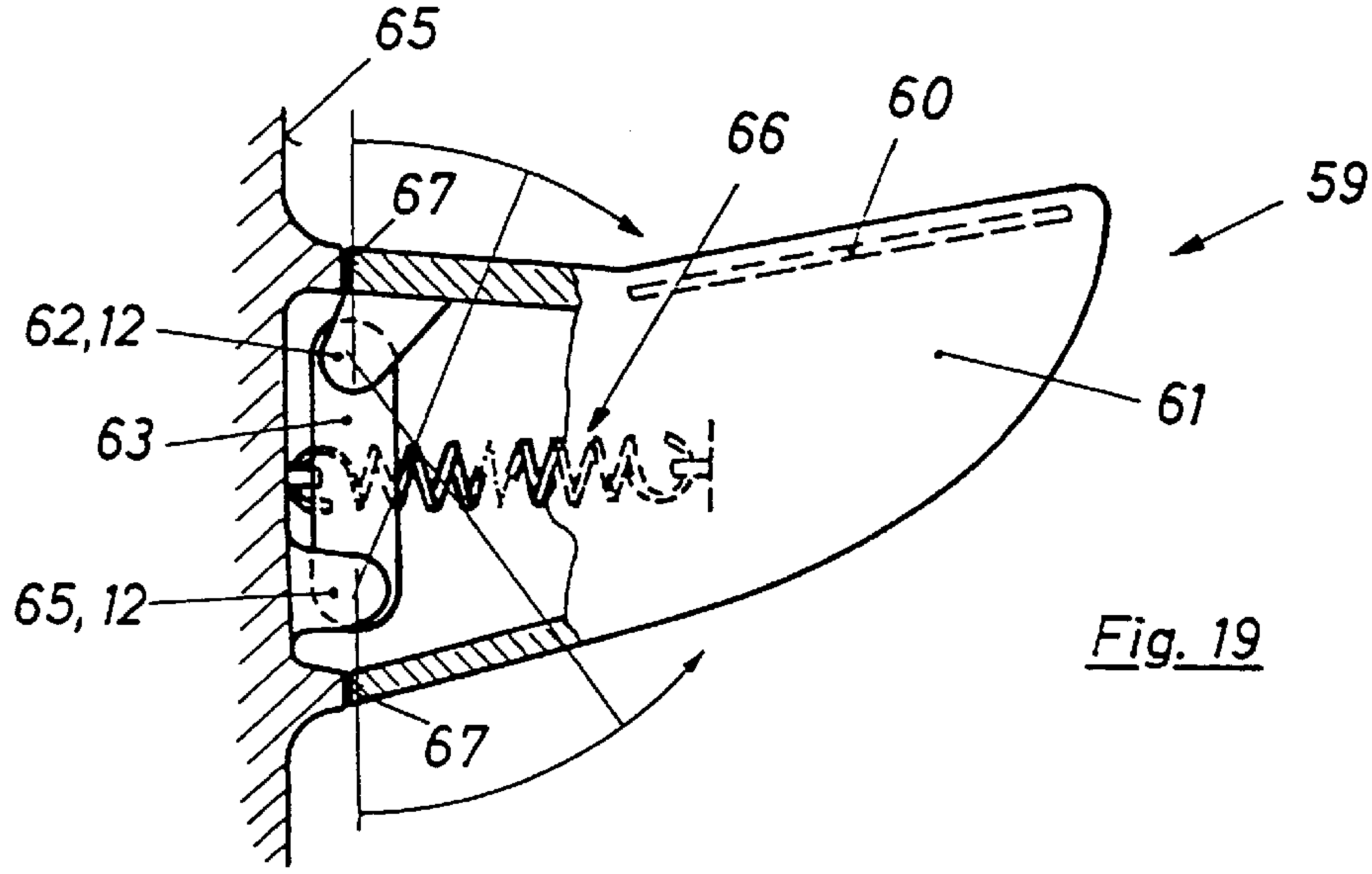


Fig. 19

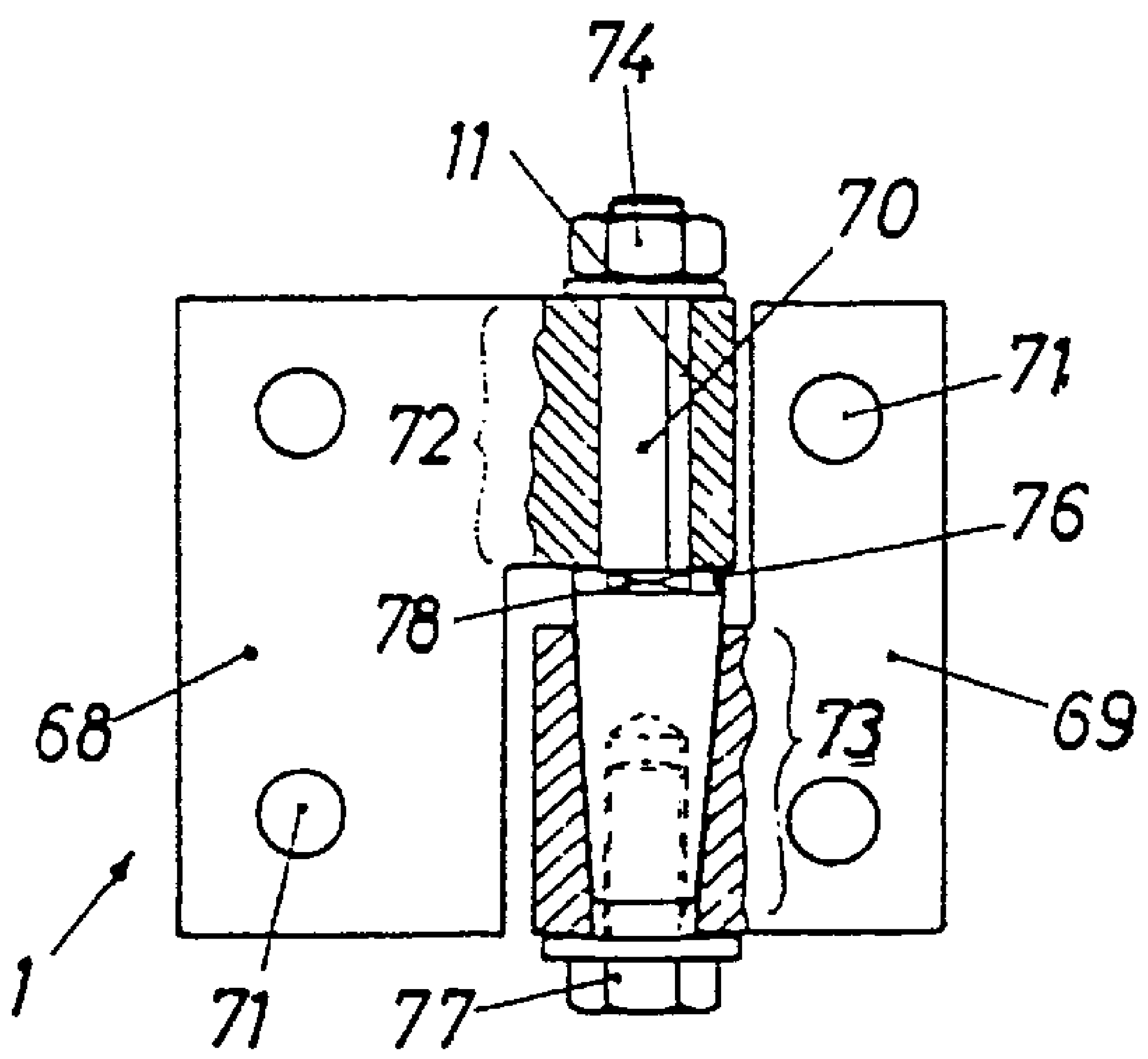


Fig. 20

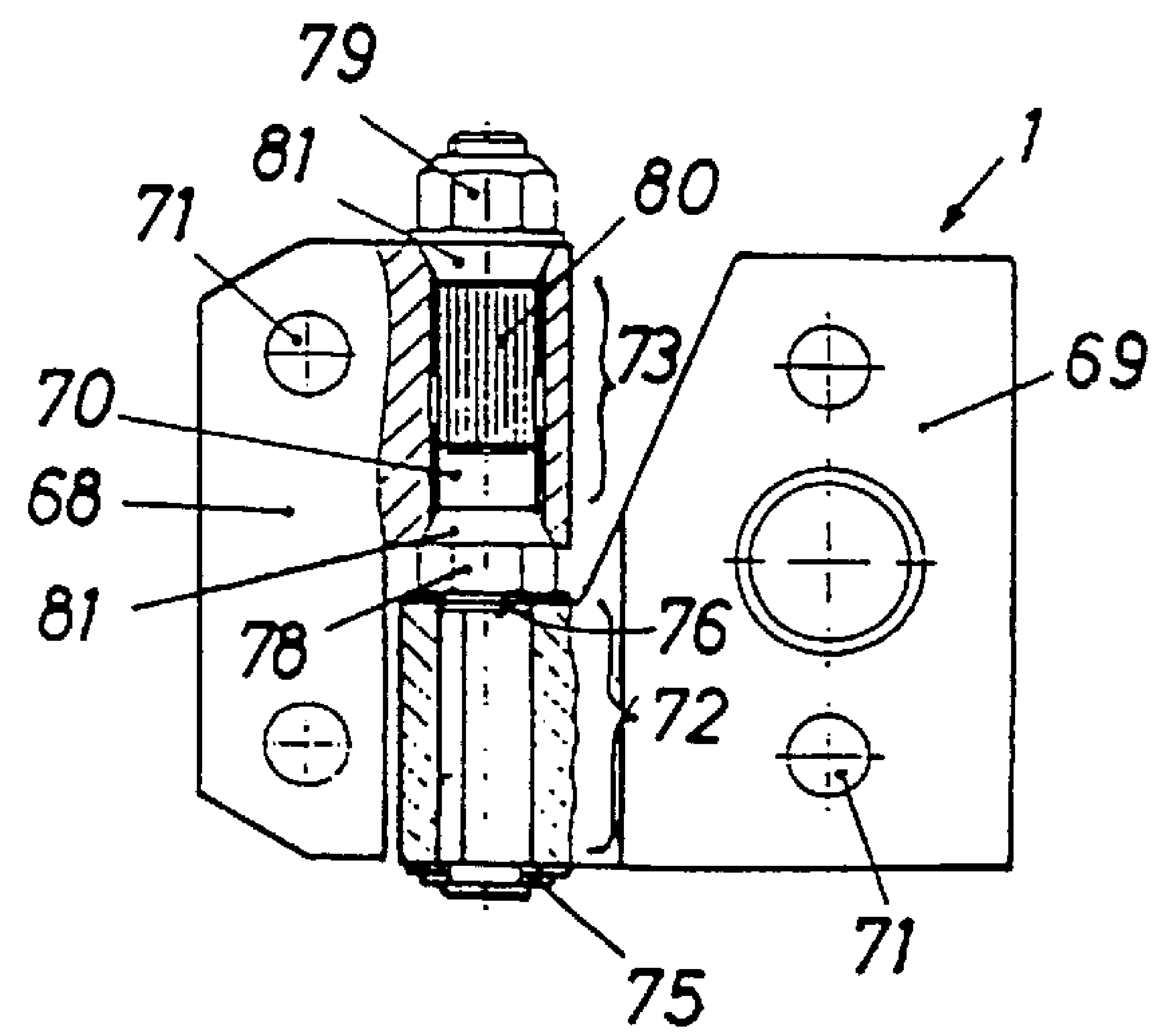


Fig. 21

HINGE FOR ACCOMMODATING A PIVOTING COMPONENT

BACKGROUND AND SUMMARY OF THE INVENTION

This application claims the priority of German application 197 26 536.7, filed in Germany on Jun. 23, 1997, and International PCT Application PCT/EP98/03611 filed in the European Patent Office on Jun. 16, 1998, the disclosures of which are expressly incorporated by reference herein.

The invention relates to a hinge for the pivotable mounting of a structural part on which there acts an adjusting force which causes said structural part to pivot, and having a pivot brake which inhibits said pivoting and is in the form of interacting cylinder wedge surfaces on the hinge pin and on at least one of the hinge plates.

Within the context of the application, hinge is intended to mean an articulated connection with at least one axis which has a shaft in the form of a hinge pin and a hub in the form of a pivotable hinge plate. Such an articulated connection may also be expressed, for example, as a door hinge or piano hinge. The hinge may also have two parallel axes between which a hinge bridge is arranged. The hinge serves for the pivotable mounting of a structural part. This means that the mounting element of the hinge is arranged in a usually fixed manner. However, this does not prevent said mounting element, on its part, from being mounted pivotably in a further articulated connection, for example the abovementioned hinge bridge about the abovementioned second axis.

Pivot brake is intended to mean an inhibiting device which sets a certain resistance, in other words an opposing force against the pivoting of the pivotable mounted structural part under the action of an adjusting force, which opposing force is usually smaller than the adjusting force. As long as the adjusting force remains smaller than the opposing force, the inhibiting device acts as a pivot stop and prevents the structural part from pivoting under the action of the adjusting force.

The adjusting force acting on the pivotably mounted structural part may be of any desired nature. It may be formed by the gravitational force, for example, on structural parts that can be pivoted about a horizontal axis, such as swing-action covers or swing-action seats; it may be applied by an energy store, such as a spring, or it may be exerted spontaneously, for example by a gust of wind acting on a door.

Cylinder wedge surfaces are intended to mean cams which, on mutually facing surfaces of the hinge pin and of the hinge plate which are equiaxial with the axis of the hinge, slope gradually upwards in wedge form from an imaginary cylinder surface in each case and then drop down sharply again onto the cylinder surface, it being the case that the cams are arranged on an inner surface of one of the structural parts and on an outer surface of the other structural part and the directions of upward slope of the cams oppose one another, and it being the case that provided between the cylinder wedge surfaces in a joining position is a joining gap which is smaller than the height of the cams beyond their respective reference cylinder surface.

DE 44 06 824 C describes a hinge with pivot stop which prevents a part which is mounted in a hinge bolt from being pivoted under the action of adjusting forces, which are not intended to cause pivoting. This achieves the situation where, for example, a door has a self-securing action in all pivot positions of its open-angle range. In this case, the braking force of the pivot brake thus always exceeds the adjusting force, which is not intended to cause pivoting.

However, there are a number of known application cases in which structural parts are intended to be pivotable with respect to one another by virtue of adjusting forces acting on them, although the intention is for this pivoting ability to be inhibited, braked or damped to a more or less pronounced extent and/or merely over part of the pivoting range. In many cases, furthermore, it is advantageous if the braking action may be calculated so as to prevent pivoting by adjusting forces which are below a threshold value. Examples of this are engine bonnets or boot lids, which have to be capable of being opened or closed by hand, but which are not intended to bang shut from the open position under the action of gravitational force and are not intended to bang shut without braking once they have been lowered from the open position. Another example is constituted by vehicle doors which, depending on their position and depending on the inclination of the vehicle, are subjected, by the gravitational force or a gust of wind, to very different moments, which are intended to be compensated for at least to the extent where a door is retained in the open position and/or does not unintentionally pivot out of this position with accelerating action without braking.

A further example is constituted by swing-action seats in public transport or in fixed seating arrangements, said swing-action seats usually being guided into the swung-up position by spring force. It is frequently desirable for said seats to be retained in a swung-down position, in order that they do not swing upwards when one stands up for a brief period of time. The intention is for the automatic swing-up operation to be initiated by a brief lifting action. Furthermore, it is not intended for such seats to be accelerated to a pronounced extent under the action of the spring force, in order that they do not strike against their top abutment. Their swing-up operation is thus intended to take place with braked action at least in the end region of their pivoting movement.

Accordingly, the object of the invention was to specify, for a hinge having a pivot brake with cylinder wedge surfaces, a rule for calculating the braking action and embodiments which can best fulfil these requirements. The invention achieves this object in that the progression of the braking moment of the pivot brake is adapted to the progression of adjusting forces acting on the structural part over the pivot angle to the effect that the adjusting force is opposed by braking force which is smaller than the adjusting force at least over a considerable part of the pivot angle.

This achieves the situation where it is only the difference between the adjusting force and the braking force which acts on the structural part. The structural part can thus be pivoted by the adjusting force over a considerable part of its pivot angle, but only in a braked, inhibited and slowed-down manner. It is thus not a more or less arbitrary progression of the braking moment of the pivot brake between assumed start and end values which is selected, but rather a progression which is adapted to the progression of the adjusting forces acting on the pivotable structural part and is determined by parameters such as mass of the pivotable structural part, swivel arm of the center of gravity of the structural part, pivot angle, inclination of the pivot axis in space and the like. Since these parameters may differ greatly from case to case, the progression of the adjusting forces and the sought-after progression of the pivoting movement have to be determined before the progression of the braking moment is established.

In one or more narrow regions of the pivot angle of the structural part it is contemplated, for the braking force of the pivot brake to exceed the adjusting force, with the result that, rather than being pivoted by the adjusting force in these regions, the structural part is blocked. These regions are usually the start or end regions of the pivot angle or, in general terms, positions in which the structural part is to be retained automatically.

In many cases, it is also advantageous if, according to contemplated arrangement, the pivot brake does not set any braking force against the adjusting force in a region of the pivot angle. This relates, in particular, to a region upstream of the start or end point of a pivot angle, which is intended to be reliably reached and retained by means of the adjusting force.

This can be achieved by corresponding dimensioning, or by appropriate angle positioning, of the wedge surfaces. For this purpose, according to contemplated arrangements, the pivot brake may be provided with a plurality of wedge surfaces which take effect in the different regions of the pivot angle and, depending on the sought-after functioning, may be provided with the same direction of slope or with opposite directions of slope. In the former case, the wedge-surface pairings take effect one after the other and the pivot brake exerts a braking force over a large pivot range. In the second case, the wedge-surface pairings come into effect depending on the pivoting direction, as a result of which the pivot brake exerts increasing braking force in the two pivoting directions. The wedge surfaces may be provided with the same or different slopes, with the result that, depending on the pivoting direction, the pivot brake may be imparted different braking action or braking action which increases progressively or degressively with the pivot angle.

It has been found to be sufficient in most cases if the pivot brake uses up at least 20% of the adjusting work performed by the adjusting force, that is to say of the product of adjusting force and pivoting distance, by braking work, that is to say by the product of braking force and pivoting distance, i.e. if the pivot brake converts this into heat energy in order to achieve sufficient braking of the movement of the respectively pivot-braked structural part.

Precisely angled adjustment of the wedge surfaces is virtually always necessary in order to allow the braking action of the pivot brake to set in, and increase, at the correct pivot angle. This is made possible by the arrangements (i) wherein the hinge pin has means for adjusting its angle position, and/or (ii) wherein the hinge pin in a second axial region, and the hinge-pin-securing hinge plate have conical fitting surfaces which can be pressed one inside the other, and/or (iii) wherein the hinge pin, in a second axial region and the hinge-pin-securing hinge plate have fitting surfaces with interengaging toothing arrangements.

Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1** and **2** are sectional views which show the principle of the wedge profiles with the pivot brake in two different positions;

FIGS. **3** and **4** show the longitudinal section through a glove box of a vehicle with a swing-action glove-box cover together with a force/pivot-angle diagram of this object;

FIGS. **5** and **6** show a illustration of the pivotable engine hood and of a pivotable trunk lid of a vehicle together with a force/pivot-angle diagram of these objects;

FIGS. **7** and **8** show the cross section through a stowage compartment of a motor vehicle with a swing-action stowage-compartment cover together with a force/pivot-angle diagram of said pivot-action stowage-compartment cover;

FIGS. **9** and **10** show the illustration of a swing-action seat together with a force/pivot-angle diagram of said swing-action seat;

FIGS. **11** and **12** show an embodiment of the wedge profiles for the object from FIG. **9** together with a force/pivot-angle diagram of said embodiments;

FIGS. **13** and **14** show an embodiment of the wedge profiles for particularly large pivot angles together with a force/pivot-angle diagram of said embodiment;

FIGS. **15** and **16** show the illustration of a swing-action bed, for example, in a motor vehicle together with a force/pivot-angle diagram of said bed;

FIGS. **17** and **18** show a handle, for example, in a motor vehicle with sectioned bearing units together with a force/pivot-angle diagram of said handle;

FIG. **19** shows the plan view of an exterior rearview mirror, which is partially broken away, with pivot brakes; and

FIGS. **20** and **21** show two partially sectioned views of hinges having pivot brakes.

DETAILED DESCRIPTION OF THE DRAWINGS

An essential design element of the present invention is constituted by the wedge profiles, the design and functioning of which will be described first of all.

As can be seen from FIG. **1**, a hinge **1** has a hinge plate **2** which acts as a hub and, on its inner surface, has a plurality of, in the illustrated embodiment two, cams **9** which are offset with respect to one another by 180° in each case, slope gradually upwards in wedge form, from an imaginary cylinder surface, inwards in the clockwise direction as far as a line **8** and then drop down sharply again to the cylinder surface. Accordingly, the hinge pin **6**, which acts as a shaft, has two cams **5** which are offset with respect to one another by 180° in each case, slope gradually upwards in wedge form, from an imaginary cylinder surface **7**, in the anticlockwise direction as far as a line **4** and then drop down sharply again to the cylinder surface. In a joining position, the rear surfaces of the cams **5** and **9** have a joining gap **10** by means of which the hinge plate **2** and hinge pin **6** can be inserted one into the other. In each case one rear surface of a cam **9** of the hub **2** and of a cam **5** of the shaft **6** form a coordinated wedge-surface pair. It is possible for a plurality of such wedge-surface pairs, which take effect synchronously, to be arranged in a rotary gap—these are referred to hereinbelow as a wedge-surface pairing **11**. Accordingly, a wedge-surface pairing **11** comprises at least one wedge-surface pair, but may also have a plurality of these, two according to FIGS. **1** and **2** but also three and, expediently in technical terms, up to six wedge-surface pairs.

The wedge-surface pairings **11** form together with the parts bearing them, the hinge plate **2** and the hinge pin **6**, a pivot brake **12**.

The two wedge-surface pairings **11** of FIGS. **1** and **2** have an operating range of approximately 120°. After passing through an angle of rotation of approximately 10° to 150°, they close the joining gap **10** and then pass into frictional engagement with one another. This frictional engagement, and thus the braking action, increases to a maximum in the case of further rotation, with increasing surface pressure. Since the contact surfaces of the rear sides of the cams **5** and **9** become shorter in this case, the braking force then decreases, despite increasing surface pressure, with the result that it is possible to utilize an angle range of approximately 120° for the braking action.

With the loading which occurs, the parts of such hinges usually consist of steel. In order to reduce the wear of the parts subjected to dry friction under high surface pressure, at least the frictional surfaces are advantageously hardened. It is possible to avoid straightforward linear contact of the wedge-surface pairings **11** being subjected to wear in that the upward slope of the wedge surfaces follows a logarithmic spiral.

As has already been mentioned, it is also possible for more than two wedge-surface pairings **11** to be distributed around the joining gap **10**, these pairings taking effect synchronously and then having a correspondingly smaller operating range. It is likewise possible for at least two wedge-surface pairings **11** to be arranged one behind the other, of which first of all one takes effect and, once the latter has exceeded its maximum braking action, the second takes effect.

By virtue of a correspondingly large joining gap **10**, it is also possible for wedge-profile pairings **11** to be provided with an initial idling region, in which case they only pass into frictional engagement, and produce a braking action, once they have passed through the same.

In FIGS. **1** and **2**, for the sake of clarity, the heights of the cams **5**, **9** are illustrated in a vastly exaggerated manner. The slope of the cams depends, in particular, on the braking action which they are intended to produce and on their number and, in most application cases, is between 1:10 and 1:100. The cams **5**, **9** are distributed at regular intervals around the circumference of the joining gap **10**. Two wedge-surface pairings **11** which take effect one after the other are used, in particular, when a large pivot angle of up to 180° is to be achieved. Otherwise, three wedge-surface pairings are preferred since these have the advantage of centering themselves.

FIG. **1** shows the wedge-surface pairings **11** in their joining position, in which they can be pushed one inside the other. FIG. **2** shows the position which they assume when in operation: the hinge pin **6** has rotated through approximately 90° in the clockwise direction during pivoting of the structural part borne by the hinge **1**. In this case, the rear surfaces of the cams **5** and **9** have advanced towards one another, have then come into contact and are then slid on one another with increasing surface pressure. In this case, they have set frictional force against the rotary movement of the hinge pin **6** to an increasing extent and have also performed deformation work and have thus increasingly inhibited the pivoting movement and reduced, and damped, the speed of said pivoting movement.

This braking, inhibiting or damping action of the braking force in relation to the adjusting force is illustrated in the figures of the drawing in each case in the right-hand, even-numbered FIGS. **4** to **18**. These figures illustrate force/pivot-angle diagrams which have the adjusting and braking forces plotted on the y-axis and the pivot angle plotted on the x-axis. The progression of the adjusting force is depicted in solid lines in each case, while the progression of the braking force is depicted by dashed lines.

FIG. **3** shows a straightforward application case of a hinge **1** having such a pivot brake **12** on the swing-action cover **13** of a glove box **14** of a vehicle. The swing-action cover **13** is mounted in a single long hinge **1**, or on two spaced-apart hinges **1**, and can be swung downwards into the position depicted by dashed lines. Following release of the locking mechanism of the swing-action cover **13**, said locking mechanism being conventional for such swing-action covers and therefore not being illustrated here, the swing-action cover drops downwards by a pivot angle of approximately 90° under the action of gravitational force, which in this case constitutes the adjusting force, and rests there on a stop (not illustrated). The basic progression of this adjusting force over the pivot angle is illustrated by the characteristic curve **15** in FIG. **4**.

In order to avoid the situation where the swing-action cover **13** drops down too quickly and strikes hard against the stop, the hinge **1**, or at least one of a plurality of hinges, is equipped with the pivot brake **12** according to the invention. By virtue of the configuration of its wedge profiles, said pivot brake is designed such that the progression of its braking force over the pivot angle basically corresponds to the characteristic curve **16** of FIG. **4**. This characteristic curve **16** of the braking force may exceed the characteristic curve **15** of the adjusting force in the initial region of the pivoting distance from 0° with the result that it is not just the case that the swing-action cover is secured by its locking mechanism in this region; rather, rattling of the swing-action cover is also prevented by the additional retaining action by means of the pivot brake. For opening purposes, the swing-action cover **13** has to be drawn a short way downwards until the adjusting force **15** exceeds the braking force **16** and the swing-action cover moves downwards of its own accord. It is, of course, possible for the progression of the braking force of the pivot brake to be selected such that it also remains under the adjusting force in the initial region of the pivoting distance, with the result that the swing-action cover **13** starts moving immediately its locking mechanism has been disengaged. In this case, it would correspond to the progression of the characteristic curve **16'**.

In the region in which the adjusting force exceeds the braking force, the swing-action cover **13** drops downwards under the action of the adjusting force, i.e. of the gravitational force. In this case, however, the swing-action cover is subjected not to the full extent of the adjusting force, but merely to the difference between the adjusting force **15** and braking force **16**, with the result that the swing-action cover moves downwards in a braked and slowed-down manner.

FIG. **5** illustrates a case in which the pivot brake **12** according to the invention is used to act on the engine hood **17** and on the trunk lid **18** of a vehicle. The weight of these swing-action covers mounted on hinges (not illustrated here) is usually at least more or less compensated for by a pneumatic spring or a steel spring. It should be assumed that the swing-action covers **17**, **18** are subjected to adjusting forces over the pivoting range of approximately 45°, said adjusting forces also being represented by the characteristic curve **19** in FIG. **6**. In order to prevent the swing-action covers **17**, **18** from dropping down under the action of said adjusting force, the latter has set against it, by a pivot brake **12** installed in the hinges **1** of the swing-action covers, a braking force which, with its progression indicated by the characteristic curve **20**, more or less compensates for the adjusting force over the pivoting range. Provision is also made here for the braking force to exceed the adjusting force in the open position of the swing-action covers, in order to retain the latter in said open position.

FIG. **7** shows a swing-action closure cover **21** on a stowage space **22** as is frequently installed beneath the floor of buses or coaches. This swing-action closure cover **21** is also mounted in hinges **1** which are equipped with pivot brakes **12**. The swing-action cover **21**, which can be pivoted through approximately 180°, is subjected to the action of gravitational force with the adjusting force, which is represented approximately by the characteristic curve **23** in FIG. **8**.

If the intention is for said adjusting force to be compensated for by the braking force completely in the open position (0° position) and closed position (180° position) of the swing-action cover **21**, and partially in the region therebetween, it is possible to install, in at least one of the hinges **1**, two pivot brakes **12** with their braking-force progressions in opposite directions and offset at an angle, as are indicated in FIG. **8** by the chain-dotted characteristic curve **24** and the chain-double dotted characteristic curve **25**. The actions of these braking forces add up to give a braking force according to the dashed braking characteristic curve **26**, which exceeds the adjusting force in the initial region **27** and in the end region **28** of the pivot angle of the swing-action cover **21** and opposes the same to a sufficient extent in the central region of said pivot angle.

Wedge profiles with braking-force progressions in opposite directions are also used for the swing-action seat **29** of FIG. **9**. The swing-action seat **29** is assumed to be pressed upwards towards the backrest **32**, with a more or less linear torque, by the adjusting force of a spring (not illustrated) installed in the hinges **1** of the swing-action axis **31**, said adjusting force being indicated by the characteristic curve **30** in FIG. **10**. In order both to retain said seat in the swung-down position and to prevent it from rattling in the pivoted-up position, the progression of the braking force is selected in accordance with the dashed characteristic curve **33** such that the braking force exceeds the adjusting force in the initial and end regions **27**, **28** of the pivoting range extending over approximately 95°. This progression of the braking force is achieved by superimposing two braking-force progressions **33'** and **33"**, which can be illustrated by means of two pivot brakes with opposite directions of slope and with a steeper upward slope of the braking force **33"** of the pivot brake which takes effect in the top end region **28**.

The wedge-surface pairings with opposite directions of slope may be offset with respect to one another, for example, in the direction of the axis of the hinge. If, however, the pivot angle is only approximately 90°, it is also possible for the two wedge-surface pairings to be offset around the circumference. This is illustrated in more detail in FIG. **11**.

It shows the cross section through the double wedge-surface pairings **11'** and **11"**, that is to say pairings which each have two cams **5** and **9**, respectively, in the joining position, that is to say in the central region of the pivot angle of the swing-action seat **29** of FIG. **9**. Starting from the axis-parallel lines **34** and **34'**, two wedge-surface pairs slope upwards in the clockwise direction, and two wedge-surface pairs slope upwards in the anticlockwise direction, over approximately 90° in each case. The tips **4**, **8** of in each case two wedge-surface pairs coincide. This gives an apparently elliptical figure which nevertheless, for reasons already mentioned above, comprise four sections, which oppose one another in pairs, of a logarithmic spiral. Starting from the joining position in the region of 45°, said wedge-surface pairings **11'** and **11"** result, upon rotation in the clockwise direction or anticlockwise direction, in the increases **35** and **36**, respectively, of the braking moment which are represented in FIG. **12**. It goes without saying that these increases may be different, for example, as a result of different slopes and/or lengths of the wedge-surface pairs.

When applied to the case of the swing-action seat **29** of FIGS. **9**/**10**, it can be seen that the braking moments **35** and **36** of the embodiment of FIGS. **11**/**12** may readily be such that they exceed the torque **30** of the swing-action seat in the initial and end regions **27**, **28** of its pivoting distance.

FIG. **13** shows an embodiment with which it is possible to achieve an increase in the braking force of wedge-surface pairings over a pivoting distance of 180° or more. Provided for this purpose are two wedge-surface pairings **11^** and **11°** which are offset with respect to one another in the axial direction and each have two wedge-surface pairs, of which, for the sake of clarity, the wedge-surface pairing **11°**, which is located to the rear in the viewing direction and is depicted by dashed lines, is illustrated with a larger diameter, although it may have the same diameter as the wedge-surface pairing **11^** which is located at the front. Starting from the joining position depicted, the wedge-surface pairing **11°** has "idling regions" **37** of approximately 90° each, in which there is no upward slope of the cam **5** of the hub **2**. Upon rotation of the shaft **6** in the anticlockwise direction, first of all it is just the rear surfaces of the wedge-surface pairing **11^** which pass into frictional engagement, which results in the increase in the braking force **38** which is illustrated by dashed lines in FIG. **14**. When, following passage through an angle of rotation of approximately 90°, said wedge-surface pairing **11^** has reached the maximum of its braking force and the latter begins to decrease, the rear surfaces of the wedge-surface pairing **11°** pass into frictional engagement and these, on their own, produce the braking force **38'**, which is represented by chain-dotted lines in FIG. **14**. The braking forces **38** and **38'** of the two wedge-surface pairings **11^** and **11°** add up to give the line **39** which is depicted by solid lines in the diagram of FIG. **14**.

The increase in the braking force **38'**, which is produced by wedge-surface pairing **11°** taking effect subsequently, is steeper as a result of the steeper upward slope of the wedge surfaces of said wedge-surface pairing, this resulting in the overall upwardly sloping progression of the braking force **39** as a whole, which can be seen from FIG. **14**.

While the swing-action seat of FIG. **9** is pressed upwards by an adjusting force applied by a spring, it is the case with the swing-action bed **40** of FIG. **15**, as is often installed in lorries, that the gravitational force seeks, as adjusting force along the characteristic curve **41** of FIG. **16**, to allow said bed, once its locking mechanism has been released, to drop downwards out of the swung-up position into the sleeping position, which is depicted by dashed lines and in which the bed is retained by straps **40'**. In order to prevent the bed from dropping down too quickly without braking, the progression of the braking force of the pivot brake **12**, which is installed in the hinges **1** of the swing-action bed **40**, is, in turn, selected in accordance with the characteristic curve **42** such that some of the pivoting work is used up by the braking work. The fact that the braking force exceeds the adjusting force again in the initial region **43** of the pivoting distance, approximately 90° from here, has the advantage that the swing-action bed, once pivoted up and locked, does not rattle in its locking mechanism under the action of travelling motion.

FIG. **17** illustrates all the details, by way of example, of the embodiment of a pivot brake using the example of a handle **44** as is often arranged on the edge of the roof in the interior of passenger vehicles. Said handles are mounted pivotably, with the result that they can be swung downwards, as required, from a rest position, in which they butt against the vehicle ceiling. The force of an installed spring means that, when they are released, the handles are pivoted back up into the rest position and retained in this rest position.

As can be seen from FIG. **17**, the handle **44** is mounted by means of two hinges **1** and **1'** at its two ends. Said hinges comprise a shaft, which is connected to the handle **44** in a rotationally fixed manner and is in the form of bearing pins **45** and **46**, and a hub in the form of in each case two bearing eyelets **47** and **48**, respectively, which are each seated on bearing plates **49** by means of which the handle can be fastened on the body of a motor vehicle. At one end, the bearing pins **45**, **46** have a polygonal stub **50** by means of which they engage in corresponding recesses of the handle and are thus connected to the latter in a rotationally fixed manner. When the handle is installed, the bearing pins **45**, **46** are inserted into the handle through an opening, which is then closed off by means of a stopper **51** being pressed in.

In the right-hand hinge **1** in FIG. **17**, a torsion spring **52** encloses the bearing pin **45** and engages in one of the bearing eyelets **47** by way of one end and in the bearing pin **45** by way of its other end. The torsion spring **52** is prestressed such that it presses the handle **44** upwards into the position depicted.

In the left-hand hinge **1'** in FIG. **17**, a tube **53** is fastened in the bearing eyelets **48** of said hinge, it being possible for the bearing pin **46** to be rotated in the tube. Said tube **53** can be injected into the bearing eyelets **48** during production of the bearing plate **49**, which takes place preferably by injection moulding. Since the angle position of the tube **53** in the bearing eyelets **48** is important for the functionally correct action of the wedge-surface pairings, the tube **53** has a groove **54** by way of which it can be positioned in the injection mould, and secured and injected therein, in a certain angle position.

In a region **55**, the tube **53** and the bearing pin **46** of the hinge **1'** have coordinated wedge-surface pairings **11**. The action of the latter is illustrated in the force/angle-of-rotational diagram of FIG. **18** over the pivot angle of 110° of the handle **44**. The adjusting force of the spring **52** is assumed to correspond to the progression of the characteristic curve **56**, and that of the braking force of the pivot brake is assumed to correspond to the characteristic curve **57**. In the assumed pivoting range of the handle, the adjusting force of the spring **52** is assumed to decrease from the value A to the value B. The wedge-surface pairings **11** are advantageously dimensioned and positioned such that they allow the handle **44** first of all a non-inhibited pivoting movement of a pivot angle of, for example, 35°. This is followed by the increasing frictional force of the wedge-surface pairings **11** setting in in accordance with the characteristic curve **57**, said frictional force counteracting the force of the spring **52** and allowing the handle to be subjected merely to the difference between the two forces, said difference being indicated by the characteristic curve **58**. This difference decreases rapidly, with the result that the handle is pivoted increasingly more slowly and pivots back into its rest position at 0° merely with a low end force, without striking forcibly against its abutment.

It can be seen that the frictional or braking force of the wedge-surface pairings **11** should be calculated such that they do not exceed the force of the spring **52**, in order that there is always spring force which presses the handle reliably back into the rest position. The braking force of the wedge-surface pairings should thus not increase beyond the value C, which is below the value B. In the rest position, the braking force of the wedge-surface pairings also has the effect of retaining the handle in this rest position. The braking force C can safely exceed the spring force B when the handle is released, for example, in the pivoted-out position and swings back into the rest position.

It can also be seen that, for the work which is to be performed by the wedge-surface pairings **11** and is under the characteristic curve **57** of this braking force, a proportion of 20% to 25% of the work which is performed by the spring **52** and is under the characteristic curve **56** of the spring is usually sufficient in order to achieve the sought-after degree of damping.

FIG. **19** shows an application case in which two pivot brakes are used in each of two interacting hinges. This figure concerns an exterior rearview mirror **59** of a motor vehicle which, when subjected to the action of correspondingly high forces, is intended to be able to yield in order that injury can be avoided.

For this purpose, the housing **61**, which contains the mirror **60**, is mounted in a hinge **62** which can be pivoted via a coupling element **63**, for its part, in a further hinge **65**, which is fixed on the body **64** of the vehicle. The housing **61** is drawn against bearing surfaces **67** by means of a spring **66** articulated on it and on the body **64**.

If the housing **61** is subjected, for example, to the action of an adjusting force which acts from the front and exceeds the moment applied by the spring **66**, the housing yields rearwards to this force by pivoting about the hinge **62**. Correspondingly, the housing **61** and the coupling element **63** yield forwards, by pivoting about the hinge **65**, as a result of an adjusting force which acts in the housing from the rear. Once the adjusting force is eliminated, the housing **61** snaps back into its initial position again under the action of the spring **66**.

In order to prevent this snapping-back operation, in the case of which it is possible to get something trapped in the quickly and forcibly closing gap between the housing **61** and one of the bearings surfaces **67**, the two hinges **62** and **65** are provided with hinge brakes **12** by means of which said snapping-back operation is slowed down, decelerated and damped.

In order that the housing returns reliably into the set starting position, the intention is for the braking force of the pivot brakes not to exceed, in any region of the pivot angle, the moment applied by the spring **66**.

As can be seen from the above descriptions, it is not only the slope and the arc length of the wedge surfaces but also the correct angle position of the wedge-surface pairings in relation to the pivoting range which plays a decisive role in the correct selection of the progression of the braking force of a pivot brake according to the invention. In order for it to be possible to adjust this angle position accurately and straightforwardly, the devices which are described hereinbelow with reference to FIGS. **20** and **21** are provided.

The hinges **1** have a first hinge plate **68** and a second hinge plate **69**, which are connected to one another by a hinge pin **70**. By way of the hinge plates **68** and **69**, the hinges **1** are fastened, on the one hand, on a fixed structural part and, on the other hand, on a pivotable structural part by means of screws which engage through holes **71**. The hinge pins **70** rotate in a first axial region **72** in the hinge plates **68** or **69** and are fastened in a second axial region **73** in the respectively other hinge plate **69** or **68**.

The first axial region **72** of the hinge pin **70** and the associated bearing bore of the hinge plates **68**, **69** have the wedge-surface pairings **11** which have already been described. A nut **74**, which can be screwed onto that end region of the hinge pin **70** which is in the form of a thread, or a clamping ring **75** interact with a collar **76** in order to secure the hinge pins in the hinge plates.

In the first embodiment of the invention according to FIG. **20**, the profiles of the second axial regions **73** of the hinge pin **70** and the bearing bore of the hinge plate **69** are of conical design. The cone surfaces may be pressed one into the other by means of a fastening screw **77**, with the result that the hinge pin **70** and the hinge plate **69** are connected to one another in a rotationally fixed manner with a force fit. The cone angle, which for the sake of clarity is depicted in a vastly exaggerated manner in the drawing, may be small, with the result that, under high surface pressure, it is possible to achieve a high retaining force against rotation.

When the moveable structural part is pivoted, the hinge pin **70** is rotated in the hinge plate **68**. At the same time, the wedge surfaces of the wedge surface pairings **11** slide on one another and progressively increase the frictional locking between the parts. As a result, the pivoting movement is progressively inhibited. The extent of this inhibiting action can be changed by virtue of the hinge pin **70** in the hinge plate **69** being rotated into a different starting position and can be readjusted in the event of wear.

For this purpose, release of the screw **77** releases the conical fit in the axial region **73** and the hinge pin **70** is rotated by a tool, which engages on a wrench-engagement surface **78** on the circumference of the collar **76**, to such an extent that the intended inhibiting action is achieved. In order to secure this new position of the hinge pin **70**, tightening the fastening screw **77** causes the components of the conical fit to be pressed on into the other again in their mutual position.

In the embodiment of FIG. **21**, the hinge pin **70** is secured in the hinge plate **68** by means of a nut **79** which can be screwed onto a thread at the top end of the hinge pin **70**. In order to secure the angle position between the hinge plate **68** and hinge pin **70**, use is made here of a profiling in the form of a toothing arrangement **80** on the second axial region **73** of the hinge pin and in the bore of the hinge plate. This interengaging toothing arrangement **80** may be designed as a serration.

In order to change the rotary position of the hinge pin **70** in the hinge plate **68**, the hinge plate is drawn off from the hinge pin once the nut **79** has been released, i.e. the structural part mounted by means of the hinge **1** is removed. The hinge pin **70** may then be rotated by a tool acting on the wrench-engagement surface **78**. Once this has taken place, the hinge plate **68** is inserted onto hinge pin **70** again, the toothing arrangement **80** sliding one into the other in a different position. Finally, the hinge plate **68** is fastened on the hinge pin **70** again by means of the nut **79**.

Since the toothing arrangements **80** have to have an amount of joining play, the hinge pin **70** and the bore of the hinge plate **68** are provided, at least on one side, with conical extensions **81** by means of which the parts can be braced with respect to one another when the nut **79** is tightened and are prevented from rattling. The nut **79** may have a conical extension **81** on the opposite side.

The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting.

Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.

What is claimed is:

1. Hinge for the pivotable mounting of a structural part on which there acts an adjusting force which causes said structural part to pivot comprising:

a pivot brake which inhibits said pivoting and is in the form of interacting cylinder wedge surfaces on a hinge pin and on at least one hinge plate operatively arranged with the structural part;

wherein the progression of a braking force of the pivot brake is adapted to the progression of the adjusting force acting on the structural part over a pivot angle to the effect that the braking force, which opposes the adjusting force, is smaller than the adjusting force at least over a considerable part of the pivot angle; and

wherein the pivot brake comprises two pairs of interacting cylinder-wedge surfaces which take effect one after the other.

2. Hinge according to claim **1**, wherein the braking force of the pivot brake exceeds the adjusting force acting on the structural part in at least one region located at a start or at an end of the pivot angle of the structural part.

3. Hinge according to claim **1**, wherein the pivot brake **(12)** does not set any opposing force against the adjusting force, acting on the structural part over at least a subregion of the pivot angle.

4. Hinge according to claim **1**, wherein at least 20% of the adjusting work corresponding to adjusting force times pivoting distance is absorbed as braking work corresponding to braking force times pivoting distance and converted into heat energy by means of the pivot brake.

5. Hinge according to claim **1**, wherein the two wedge-surface pairs are arranged in a rotary gap of a hinge.

6. Hinge according to claim **1**, wherein the two wedge-surface pairs slope upwards in opposite directions and with opposite directions of slope starting from a joining position.

7. Hinge according to claim **6**, wherein the hinge pin has means for adjusting its angle position.

8. Hinge according to claim **1**, wherein the two wedge-surface pairs slope upwards one after the other with the same direction of slope starting from a joining position.

9. Hinge according to claim **1**, wherein the pivot brake has two to six wedge-surface pairs.

10. Hinge according to claim **9**, wherein the hinge pin has means for adjusting its angle position.

11. Hinge according to claim **1**, wherein the hinge pin has means for adjusting its angle position.

12. Hinge according to claim **11**, wherein the hinge pin in a second axial region, and the hinge-pin-securing hinge plate have conical fitting surfaces which can be pressed one inside the other.

13. Hinge according to claim **11**, wherein the hinge pin, in a second axial region, and the hinge-pin-securing hinge plate have fitting surfaces with interengaging toothing arrangements.

14. Hinge according to claim **1**, wherein the hinge pin has means for adjusting its angle position.

15. Hinge according to claim **1**, wherein the structural part is a passenger vehicle hood.

16. Hinge according to claim **1**, wherein the structural part is a passenger vehicle trunk lid.

17. Hinge according to claim **1**, wherein the structural part is a passenger vehicle stowage compartment cover.

18. Hinge according to claim **1**, wherein the structural part is a passenger vehicle seat.

19. Hinge according to claim **1**, wherein the structural part is a passenger vehicle bed.

20. Hinge according to claim **1**, wherein the structural part is a passenger vehicle support handle.

21. Hinge according to claim **1**, wherein the structural part is a vehicle mirror assembly.

22. Hinge assembly for pivotably mounting a structural part which in use is acted on by an adjusting force to pivot over a pivot angle, comprising:

a pair of hinge plates, one of said hinge plates being connected to move with the structural part, and

a hinge pin pivotably connecting the hinge plates,

wherein the hinge pin and at least one of the hinge plates are provided with interacting inclined surfaces which act as a pivot brake controlling resistance to pivotal movement of the structural part as a function of a pivotal position of the structural part, said inclined surfaces being configured to apply a resistance force opposing the adjusting force which is smaller than the adjusting force at least over a considerable portion of the pivot angle,

wherein the pivot brake comprises two pairs of interacting cylinder-wedge surfaces which take effect one after the other.

23. Hinge assembly according to claim **22**, wherein the structural part is a passenger motor vehicle part.

* * * * *